

**What is claimed is:**

1. An apparatus comprising a nozzle including a first injector for injecting a highly-carbon-laden gas, the nozzle including at least one second injector for injecting a mixture of a fuel and an oxidant for a pilot flame, the nozzle secured in a moveable head assembly, the head assembly comprising a main gas block and an ignition source mounted in a gas plenum which encloses respective tips of the first and second injectors, the highly-carbon-laden gas and the fuel and oxidant mixture adapted to exit through these tips and enter and fill the gas plenum.

2. Apparatus in accordance with claim 1 wherein the nozzle is adapted to be quickly removed and replaced by an identical nozzle.

3. Apparatus in accordance with claim 1 wherein the nozzle is adapted to be quickly removed and replaced by a non-identical nozzle.

4. Apparatus in accordance with claim 1 wherein the head assembly is removeably secured to a funnel arm shaft block.

5. Apparatus in accordance with claim 4 wherein the head assembly is equipped with at least two gas supply connections, one for highly-carbon-laden gas, and one for mixture of fuel and oxidant for a pilot flame.

6. Apparatus in accordance with claim 5 wherein the head assembly is equipped with a third gas supply connection for purge gas.

7. Apparatus in accordance with claim 5 or claim 6 wherein the gas supply connections are connected to gas supply conduits which are connected in

1            14. Apparatus in accordance with claim 1 comprising an automatic ignition  
2            system, the automatic ignition system comprising a spark producing means inserted  
3            in said gas plenum, electronic connections for allowing electronic controls of an IS

4 machine to control the spark producing means, and logic software capable of  
5 interacting with the electronic controls of an IS machine.

1 15. Apparatus in accordance with claim 1 wherein said gas plenum is  
2 formed by a shield and shelf combination.

1 16. Apparatus in accordance with claim 1 comprising one or more deflector  
2 jets installed at points substantially between first and second nozzles, the deflector  
3 jet adapted to direct a small sample of fuel gas and oxidant toward the ignition  
4 source.

1 17. A nozzle comprising:

2 a) a substantially hollow, substantially cylindrical body having a gas exit  
3 end and a connection end, the gas exit end having an end cap having  
4 a central orifice and at least one non-central orifice, the central orifice  
5 having positioned therein a hollow tube having its first end extending  
6 into the central orifice and a second end extending into the  
7 substantially hollow, substantially cylindrical body, the second end of  
8 the hollow tube being supported by and extending through a support  
9 plate positioned in an interior location of the substantially hollow,  
10 substantially cylindrical body, the connection end of the substantially  
11 hollow, substantially cylindrical body adapted to be mated with a  
12 sealing member when the nozzle is installed for use;

13 b) the support plate positioned to divide the interior of the substantially  
14 hollow, substantially cylindrical body into a first chamber and a second  
15 chamber, the first chamber defined by the support plate, end cap, and  
16 a first interior surface of the substantially hollow, substantially  
17 cylindrical body, the second chamber defined by the support plate,

18 sealing member, and a second interior surface of the substantially  
19 hollow, substantially cylindrical body;  
20 c) the substantially hollow, substantially cylindrical body having at least  
21 one orifice extending from an exterior surface of the body to the first  
22 chamber, and at least one orifice extending from the exterior surface of  
23 the body to the second chamber.

1 18. Nozzle in accordance with claim 17 wherein the sealing member is a  
2 threaded bolt having male threads adapted to mate with female threads on the  
3 second interior surface of the body.

1 19. Nozzle in accordance with claim 17 having at least three non-central  
2 orifices.

1 20. Nozzle in accordance with claim 17 wherein the first end of the tube  
2 extends through the central orifice and wherein the first end is extended away from  
3 the end cap a distance ranging from 0 centimeter to about 5 centimeters.

1 21. Nozzle in accordance with claim 17 which has at least two orifices  
2 extending from the exterior surface of the body to the second chamber.

1 22. A head assembly comprising a main gas block, the main gas block  
2 having a support portion and header, the support portion having at least two gas  
3 supply connections, a first gas supply connection adapted for accepting flow of a  
4 highly-carbon-laden gas, and a second gas supply connection adapted for accepting  
5 flow of a mixture of fuel and oxidant, the gas supply connections adapted to be  
6 connected to gas supply conduits, the first and second gas supply connections  
7 connected to respective conduits internal to said support section and said header for

8 supplying said gases to at least one nozzle for depositing carbon black, said nozzle  
9 positioned in a hole in said header.

1 23. Head assembly in accordance with claim 22 wherein the support  
2 section has a third gas supply connection, the third gas supply connection adapted  
3 to receive a flow of a purge gas, the third gas supply connection connected to  
4 respective conduits internal to said support portion and said header to supply purge  
5 gas to said at least one nozzle.

1 24. Head assembly in accordance with claim 22 comprising a shield  
2 substantially surrounding a gas exit end of the nozzle.

1 25. Head assembly in accordance with claim 24 comprising a spark igniter  
2 positioned in a side of the shield.

1 26. Head assembly in accordance with claim 25 comprising a purge gas  
2 nozzle positioned on an under side of the header and protruding into a space  
3 created by the shield, the purge gas nozzle positioned to direct a flow of purge gas  
4 near the spark igniter.

1 27. Head assembly in accordance with claim 22 comprising a removeable  
2 head assembly mounting plate comprising a T-tongued plate that serves to position  
3 the head assembly on a clamp block.

1 28. Head assembly in accordance with claim 27 wherein the head  
2 assembly mounting plate has off-setting bolt holes from a center line of the mounting  
3 plate.

29. A clamp block allowing height adjustment on a shaft, the clamp block comprising a T-slot adapted to accept a T-tongue of a mounting plate, and a rectangular slot adapted to receive an engaging nut, the clamp block comprising two halves secured together using matching clamp block clamp halves using a clamp block bolt and engagement nut, the clamp block having a clamp block shaft hole adapted to accommodate a shaft.

30. An automatic ignition system comprising an electronic controller and a spark igniter, the electronic controller adapted to initiate flow of fuel and oxidant gases, and adapted to cause an electrical signal to the spark igniter and ignite a pilot flame at least one cycle before a firing cycle, and deactivate the flow of fuel and oxidant gases following a scheduled need for said pilot flame.

31. A cyclic method of depositing carbon black on a surface, the method comprising:

- a) providing a head assembly including a nozzle, the nozzle including a first injector for injecting a highly-carbon-laden gas, and at least one second injector for injecting a mixture of a fuel and an oxidant to produce one or more pilot flames;
- b) igniting the pilot flames;
- c) indexing the head assembly over a substrate on which is to be deposited carbon black with pilot flames lit;
- d) flowing the highly-carbon-laden gas through the first injector, then through said one or more pilot flames emitted from the second injectors, and finally toward the substrate to be coated with carbon black, but only when a deposit of carbon black is desired;
- e) ceasing the flow of highly-carbon-laden gas;

- 15 f) indexing the nozzle away from the substrate on which was just
- 16 deposited the carbon black after a carbon black deposition sequence;
- 17 and
- 18 g) ceasing fuel gas and oxidant gas flows through the second injectors.

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